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SUPPLEMENTARY ONLINE MATERIAL FOR

Climate-driven diversity changes of Mediterranean echinoids over the last 6 Ma

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Supplementary Online Material

Table S1. List of echinoid genera discussed in the main text and their respective species with localities and stratigraphy.

References

Table S2. Quantitative data on bathymetrical distribution of shelf-preferring/exclusive echinoid genera that still live or lived in Mediterranean during the late Cenozoic

Table S3. Average annual sea surface temperatures reported for echinoid genera that still live or lived in Mediterranean during the late Cenozoic.

References

Table S4. List of echinoid genera discussed in the main text and their respective extant species, with localities and average annual sea surface temperatures (SSTs).

References

Table S5. Classes of sea surface temperature (SST) requirements showed by still living echinoid genera accross the Mediterranean late Cenozoic and related plot.

Table S1. List of echinoid genera discussed in the main text and their respective species with localities and stratigraphy.

REGULAR ECHINOIDS				
Genus	**Species**	**Sites/Biogeography**	**Stratigraphy**	**References**
Arbacia Gray, 1835	*Arbacia* sp.	Cabo de Gata (Spain)	Pliocene (Piacenzian)	L. Hernandez and P. Nicolleau personal communication
	A. lixula (Linnaeus, 1758)	Livorno (Tuscany, Italy)	Late Pleistocene	Tortonese (1965)
	" "	Mediterranean Sea	Recent	Tortonese (1965)
Arbacina Pomel, 1869	*A. catenata* (Desor in Agassiz and Desor, 1847a)	Almeria (Spain)	Messinian	Roman and Soudet (1990)
	" "	Seville (Spain)	Messinian	Bajo et al. (2008)
	A. romana Merian in Desor, 1858	Betique Region (Spain)	Messinian to Pliocene	Roman and Soudet (1990)
	" "	Altavilla (Sicily, Italy)	Pliocene	Checchia Rispoli (1916)
	" "	Anzio (Lazio, Italy)	Gelasian	Checchia Rispoli (1923)
	" "	Favignana Isle (Sicily, Italy)	Calabrian	Borghi and Garilli (2017)
	" "	Palermo (Sicily, Italy)	Calabrian	Checchia Rispoli, 1907)
Centrostephanus Peters, 1855	*Centrostephanus* sp.	Spain	Messinian	Roman and Soudet (1990)
	Centrostephanus sp.	Italy	Pliocene	Tortonese (1965)
	C. longispinus (Philippi, 1845)	Diolo, Stirone River (Emilia, Italy)	Piacenzian	Borghi (2003)
	" "	Mediterranean Sea	Recent	Tortonese (1965)
Cidaris Leske, 1778	*Cidaris* sp.	Mediterranean area	Messinian to Recent	Néraudeau *et al*. (1999)

	C. cidaris (Linnaeus, 1758)	Pianosa Isle (Tuscany, Italy)	Piacenzian	Simonelli (1889)
	" "	Alicante (Spain)	Pliocene	Montenat and Roman (1970)
	" "	Favignana Isle (Sicily, Italy)	Calabrian	Borghi *et al*. (2006)
	" "	Stirone River (Emilia, Italy)	Calabrian	Borghi (1999)
	" "	Mediterranean area	Recent	Tortonese (1965)
	C. margaritifera (Meneghini, 1862)	Emilia, Tuscany, Sicily	Zanclean to Calabrian	Meneghini 1862; Borghi 1999, Borghi et al. 2014
	C. remiger Ponzi, 1858	Rome	Zanclean	Ponzi 1858; Checchia Rispoli 1919
Diadema Gray, 1825	*D. setosum* (Leske, 1778)	Mediterranean area	Recent	Por (2009)
Echinus Linnaeus, 1758	*E. algirus* Pomel, 1887	North Africa	Messinian	Roman and Soudet (1990)
	" "	El Achour, Dely-Brahim (Algeria)	Pliocene	Pomel (1887)
	" "	Carboneras (Spain)	Pliocene	Echinologia (2021)
	E. melo Lamarck, 1816	Almeria (Spain)	Pliocene	Echinologia (2021)
	" "	Stirone River (Emilia, Italy) Favignana Isle (Sicily, Italy)	Calabrian	personal observation
	" "	Mediterranean Sea	Recent	Tortonese (1965)
Eucidaris Pomel, 1883	*Eucidaris* sp.	Mediterranean area	Messinian	Néraudeau *et al*. (1999)
	E. desmoulinsi (Sismonda, 1842)	Orciano (Tuscany, Italy)	Zanclean	Borghi (1999)
		Montaldo Roero (Piedmont, Italy), Campore (Emilia, Italy)	Piacenzian	Borghi (1999)
		Pianosa Isle (Tuscany, Italy)	Piacenzian	Simonelli (1889)
Genocidaris A. Agassiz, 1869	*Genocidaris* sp.	Mediterranean area	Messinian	Néraudeau *et al*. (1999)

	G. maculata Agassiz, 1869	Almeria (Spain)	Zanclean	Echinologia (2021)
	" "	Campore, Castell'Arquato, Diolo, Stirone River, San Polo (Emilia, Italy)	Piacenzian - Calabrian	Borghi (1995a)
	" "	Capo Milazzo (Sicily, Italy)	Late Pleistocene	Borghi *et al*. (2014)
		Mediterranean Sea	Recent	Tortonese (1965)
Gracilechinus Fell and Pawson, 1966	*G. elegans* (Duben and Koren, 1844)	Almeria (Spain)	Pliocene	Echinologia (2021)
	G. acutus (Lamarck, 1816)	Spain	Pliocene "1 and 2"	Roman and Soudet (1990)
	" "	Campore, Diolo (Emilia, Italy)	Piacenzian	" "
	" "	Capo Milazzo. Salice (Sicily, Italy)	late Piacenzian, Gelasian, Calabrian	Borghi *et al*. (2014)
	" "	Anzio (Lazio, Italy)	Gelasian	Checchia Rispoli (1923)
	" "	Stirone River (Emilia, Italy)	Calabrian	Borghi (1993a)
	" "	Mediterranean Sea	Recent	Tortonese (1965)
Histocidaris Mortensen, 1903	*Histocidaris* sp.	Almeria (Spain)	Messinian	Roman and Soudet (1990)
	H. rosaria (Bronn, 1831)	Argille Azzurre Fm. of Piedmont, Emilia, Umbria, Tuscany (Italy)	Zanclean - Piacenzian	Meneghini (1862); Landi (1929), Borghi *et al*. (2014)
	" "	Rome	Zanclean	Checchia Rispoli (1919)
	" "	Campore (Emilia, Italy)	Piacenzian	personal obs. by the authors
	H. sicula Borghi, 1999	Capo Milazzo, Salice (Sicily, Italy)	late Piacenzian, Gelasian, Calabrian	Borghi (1999), Borghi *et al*. (2014)
Paracentrotus Mortensen, 1903	*P. lividus* (Lamarck, 1816)	S. Colombano (Lombardy, Italy)	Calabrian	Airaghi (1898)
	" "	Stirone River (Emilia, Italy)	Calabrian	Borghi (1995a, 2003)

	" "	Favignana Isle (Sicily, Italy)	Calabrian	Borghi and Garilli (2017)
	" "	Capo Milazzo (Sicily, Italy)	Late Pleistocene	Borghi *et al*. (2014)
	" "	Mediterranean Sea	Recent	Tortonese (1965)
Placentinechinus Borghi and Garilli, 2016	*P. davolii* Borghi and Garilli, 2016	S. Anna (Calabria, Italy) Puglia and Sicily (Italy)	Gelasian Calabrian	Borghi and Garilli (2017)
Prionocidaris A. Agassiz, 1863	*P. avenionensis* (Des Moulins, 1837)	Iscala Sale (Sardinia, Italy)	Messinian	Cotteau (1895)
	" "	Cagliari (Sardinia, Italy)	Messinian	Lambert (1907)
	" "	Campore (Emilia, Italy)	Piacenzian	personal observation
Psammechinus L. Agassiz, 1846	*P. dubius* (L. Agassiz, 1840)	Spain	Messinian	Montenat and Roman (1970)
	" "	North Africa and Spain	Messinian	Roman and Soudet (1990)
	P. tortonicus (Gregory, 1891)	Malta	Messinian	Cappelletti (2008)
	P. astensis Sismonda, 1842	Pianosa Isle (Tuscany, Italy)	Piacenzian	Simonelli (1889)
	" "	Emilia (Italy)	Piacenzian to Calabrian	Borghi (2021a)
	" "	Anzio (Lazio, Italy)	Gelasian	Checchia Rispoli (1923)
	" "	Favignana Isle (Sicily, Italy)	Calabrian	Borghi and Garilli (2017)
Schizechinus Pomel, 1869	*S. duciei* (Wright, 1855)	Alicante (Spain)	Messinian	Montenat and Roman (1970)
	" "	Melilla (North Africa)	Messinian	Lachkhem and Roman, 1995)
	" "	Seville (Spain)	Messinian	Bajo *et al*. (2008)
	" "	Malta	Messinian	Cappelletti (2008)
	S. serialis Pomel, 1887	Almeria (Spain)	Messinian - Zanclean	Roman and Soudet (1990)

	“ “	Diolo, Campore Campore (Emilia, Italy)	Piacenzian Gelasian	personal observation
	“ “	Anzio (Lazio, Italy)	Gelasian	Checchia Rispoli (1923)
	“ “	S. Colombano (Lombardy, Italy)	Calabrian	Airaghi (1898)
	“ “	Emilia, Puglia, Sicily (Italy)	Calabrian	Borghi *et al*. (2018)
Sphaerechinus Desor, 1856	*S. granularis* (Lamarck, 1816)	Stirone River (Emilia, Italy)	Calabrian	Borghi (2003)
	“ “	Favignana Isle (Sicily, Italy)	Calabrian	Borghi and Garilli (2017)
	“ “	Mediterranean Sea	Recent	Tortonese (1965)
Stirechinus Desor, 1856	*S. scillae* Desor, 1856	France Malta	late Miocene Messinian	Smith and Kroh (2011)
	“ “	Capo Milazzo, Salice (Sicily, Italy)	late Piacenzian, Gelasian, Calabrian	Borghi *et al*. (2014)
Stylocidaris Mortensen, 1909	*S. affinis* (Philippi, 1845)	Carboneras (Spain)	Pliocene	Echinologia (2021)
	“ “	Stirone River (Emilia, Italy)	Calabrian	Borghi (1999)
	“ “	Mediterranean Sea	Recent	Tortonese (1965)
	S. melitensis (Wright, 1855)	Malta	Messinian	Stefanini (1908)
	“ “	Alicante (Spain)	Messinian	Echinologia (2021)
Tripneustes L. Agassiz, 1841	*T. planus* (L. Agassiz in Agassiz and Desor, 1847b)	Almeria (Spain)	Messinian	Roman and Soudet (1990)
	“ “	Melilla, North Africa	Piacenzian	Lachkhem and Roman (1995)
	T. gahardensis (Seunes, 1896)	Spain	Pliocene “1”	Roman and Soudet (1990)

IRREGULAR ECHINOIDS				
Genus	**Species**	**Sites/Biogeography**	**Stratigraphy**	**References**
Amblypygus L. Agassiz, 1840	*A. arnoldi* L. Agassiz (1841)	Siena (Tuscany, Italy)	Piacenzian	L. Agassiz (1841)
	A. lorioli Simonelli, 1889	Algeria	Messinian	Roman and Saint Martin (1987)
	" "	Pianosa Isle (Tuscany, Italy)	Piacenzian	Simonelli (1889)
Amphiope L. Agassiz, 1840	*Amphiope* sp.	Cagliari (Sardinia, Italy)	Messinian	Stara and Borghi (2014)
	A. tipasensis (Aymé and Roman, 1954)	Algeria	Pliocene	Aymé and Roman (1954)
Brissopsis L. Agassiz, 1840	*B. lyrifera* (Forbes, 1841)	Almeria (Spain)	Messinian (pre- and during the MSC)	Lacour and Néraudeau (2000)
	" "	Rome	Zanclean	Checchia Rispoli (1919)
	" "	Melilla, North Africa	Piacenzian	Lachkhem and Roman (1995)
	" "	Emilia (Italy)	Zanclean to Calabrian	Borghi (1997a)
	" "	Anzio (Lazio, Italy)	Gelasian	Checchia Rispoli (1923)
	" "	Mediterranean Sea	Recent	Tortonese (1965)
	B. atlantica Mortensen, 1913	Almeria (Spain)	Messinian	Lacour and Néraudeau (2000)
	" "	Emilia (Italy)	Piacenzian to Calabrian	Borghi (1997a)
	" "	Mediterranean Sea	Recent	Tortonese (1965)
Brissus Gray, 1825	*B. unicolor* (Leske, 1778)	Melilla, North Africa	Messinian	Lachkhem and Roman (1995)
	" "	Almeria (Spain)	Messinian - Pliocene	Roman and Soudet (1990)
	" "	Pianosa Isle (Tuscany, Italy)	Piacenzian	Simonelli (1889)
	" "	San Polo d'Enza (Emilia, Italy)	Calabrian	personal observation

	" "	Favignana Isle (Sicily, Italy)	Calabrian	Borghi *et al*. (2006)
	" "	Mediterranean Sea	Recent	Tortonese (1965)
Clypeaster Lamarck, 1801	*C. altus* (Leske, 1778)	Almeria (Spain)	Messinian - Pliocene	Roman and Soudet (1990)
	" "	Malta	Messinian	Cappelletti (2008)
	C. marginatus Lamarck, 1816	Melilla, North Africa	Messinian	Lachkhem and Roman (1995)
	" "	Almeria (Spain)	Messinian	Rose and Wood (1999)
	C. altus (Leske, 1778)	Almeria (Spain)	Messinian - Pliocene	Roman and Soudet (1990)
	" "	Malta	Messinian	Cappelletti (2008)
	" "	Tuscany (Italy)	Pliocene	Esu and Kotsakis (1981)
Echinocardium Gray, 1825	*E. cordatum* (Pennant, 1777)	Almeria (Spain)	Pliocene	Roman and Soudet (1990)
	" "	Anzio (Lazio, Italy)	Gelasian	Checchia Rispoli (1923)
	" "	Emilia (Italy)	Calabrian	Borghi (1997b)
	" "	Favignana Isle (Sicily, Italy)	Calabrian	Borghi *et al*. (2006)
	E. flavescens (Muller, 1776)	Mediterranean Sea	Recent	Tortonese (1965)
	E. depressum (L. Agassiz in Agassiz and Desor, 1847a)	Seville (Spain)	Messinian	Bajo *et al*. (2008)
	E. mediterraneum (Forbes, 1841)	Mediterranean Sea	Recent	Tortonese (1965)
	E. mortenseni Thiéry, 1909	Mediterranean Sea	Recent	Tortonese (1965)
	E. melii Checchia Rispoli, 1923	Anzio (Lazio, Italy)	Gelasian	Checchia Rispoli, 1923
	" "	Emilia (Italy)	Calabrian	Borghi (1997b)
	" "	Favignana Isle (Sicily, Italy)	Calabrian	Borghi *et al*. (2006)

Echinocyamus Phelsum, 1774	*E. pusillus* (Muller, 1776)	Melilla, North Africa	Messinian	Lachkhem and Roman (1995)
	" "	Alicante (Spain)	Messinian	Montenat and Roman (1970)
	" "	Piedmont, Liguria (Italy)	Zanclean - Piacenzian	Airaghi (1901)
	" "	Almeria (Spain)	Pliocene	Roman and Soudet (1990)
	" "	Emilia (Italy)	Pliocene - Pleistocene	Borghi (1993b)
	" "	Pianosa Isle (Tuscany, Italy)	Piacenzian	Simonelli (1889)
	" "	Anzio (Lazio, Italy)	Gelasian	Checchia Rispoli (1923)
	" "	Favignana Isle (Sicily, Italy)	Calabrian	Borghi *et al*. (2006)
	" "	Capo Milazzo (Sicily, Italy)	Late Pleistocene	Borghi *et al*. (2014)
	" "	Mediterranean Sea	Recent	Tortonese (1965)
Echinolampas Gray, 1825	*E. deshayesi* Desor in Agassiz and Desor, 1847a	Almeria (Spain)	Messinian - Pliocene	Roman and Soudet (1990)
	E. hoffmanni Desor in Agassiz and Desor, 1847a	Melilla, North Africa	Messinian	Lachkhem and Roman (1995)
	" "	Spain Rhodes Island (Greece)	Zanclean Piacenzian, Calabrian	Echinologia (2021)
	" "	Pianosa Isle (Tuscany, Italy)	Piacenzian	Simonelli (1889)
	" "	Favignana Isle (Sicily, Italy)	Calabrian	Borghi *et al*. (2006)
	E. manzonii Pomel, 1883	Almeria (Spain)	Messinian	Roman and Soudet (1990)
	" "	Murcia (Spain)	Piacenzian	Echinologia (2021)
	E. wrighti Gregory, 1891	Malta	Messinian	Cappelletti (2008)
	" "	Almeria (Spain)	Pliocene	Roman and Soudet (1990)

Echinoneus Leske, 1778	*E. cyclostomus* Leske, 1778	Malta	Messinian	Challis (1980)
	" "	Cabo Cope (Spain)	Piacenzian	pers. comm. D. Garcia Ramos
Granopatagus Lambert, 1915	*G. subinermis* (Pomel, 1887)	Algeria	late Miocene - Pliocene	Pomel (1887)
	" "	Almeria (Spain)	Pliocene	Roman and Soudet (1990)
	" "	Pianosa Isle (Tuscany, Italy)	Piacenzian	Simonelli (1889)
	" "	Anzio (Lazio, Italy)	Gelasian	Checchia Rispoli (1923)
	" "	Emilia (Italy)	Calabrian	Néraudeau *et al*. (1998)
	" "	Favignana Isle (Sicily, Italy)	Calabrian	Borghi *et al*. (2006)
	" "	Mediterranean Sea	Recent	Tortonese (1965)
Hypsoclypus Pomel, 1869	*H. doma* Pomel, 1887	Almeria (Spain)	Messinian	Roman and Soudet (1990)
	H. lata Pomel, 1887	Melilla, North Africa	Messinian	Lachkhem and Roman (1995)
	H. pouyannei Pomel, 1887	Mediterranean area	Messinian - Pliocene	Néraudeau *et al*. (2001)
	" "	Pomarance (Tuscany, Italy)	Piacenzian	Borghi and Ciappelli (2014)
Holanthus Lambert and Thiéry, 1925	*Holanthus* sp.	Mediterranean area	Messinian	Néraudeau *et al*. (2001)
	H. ovatus (Sismonda, 1842)	Rome	Zanclean	Checchia Rispoli (1919)
	" "	Capo Milazzo, Salice (Sicily, Italy)	late Piacenzian, Gelasian, Calabrian	Borghi *et al*. (2014)
		Piedmont, Emilia (Italy)	Zanclean - Piacenzian	
	H. expergitus (Loven, 1874)	Mediterranean Sea	Recent	Tortonese (1965)
Holaster L. Agassiz, 1836	*Holaster* sp.	Piedmont, Emilia (Italy)	Messinian	personal observation
Mazettia Lambert and Thiéry in Lambert, 1915	*Maretia pareti* Manzoni, 1879	Emilia (Italy)	Zanclean	Borghi *et al*. (in press)

Neolampas A. Agassiz, 1869	*N. rostellata* A. Agassiz, 1869	Mediterranean Sea	Recent	Tortonese (1965)
Opissaster Pomel, 1883	*O. polygonalis* Pomel, 1869	Algeria	Pliocene	Pomel (1869)
	O. insignis Pomel, 1887	Oran (Algeria)	Messinian - Pliocene	Cotteau et al. (1891), Néraudeau (1994)
	O. jourdyi (Cotteau, Peron and Gauthier, 1891)	Algeria	Pliocene	Cotteau *et al*. (1891)
Ova Gray, 1825	*O. canalifera* (Lamarck, 1816)	Spain	Zanclean to Piacenzian,	Roman and Soudet (1990)
	" "	Almeria (Spain)	Pliocene	Echinologia (2021)
	" "	Emilia (Italy)	Piacenzian to Calabrian	Borghi (2021b)
	" "	Mediterranean Sea	Recent	Tortonese (1965)
	O. saheliensis (Pomel, 1887)	Mediterranean area	late Miocene to Pliocene	Smith and Kroh (2011)
	" "	Melilla, North Africa	Messinian	Lachkhem and Roman (1995), Néraudeau *et al*. (2001)
Peribrissus Pomel, 1869	*P. saheliensis* Pomel, 1869	Algeria	Miocene	Pomel (1869)
	" "	Algeria	Messinian - Pliocene "1"	Néraudeau *et al*. (2001)
	P. sotgiai Di Giorgio, 1923	Sardinia (Italy)	late Miocene	Di Giorgio (1923)
Plagiobrissus Pomel, 1883	*P. imbricatus* (Wright, 1855)	Malta	Messinian	Cappelletti (2008)
	P. costae (Gasco, 1876)	Melilla (North Africa)	Messinian	Lachkhem and Roman (1995)
	" "	Seville (Spain)	Messinian	Bajo *et al*. (2008)
	" "	Almeria (Spain)	Zanclean - Piacenzian	Roman and Soudet (1990)
	" "	Stirone River (Emilia, Italy)	Calabrian	Borghi (1993c)
	" "	Mediterranean Sea	Recent	Tortonese (1965)

Pliolampas Pomel, 1888	*P.* aff *medfensis*	Mediterranean area	Messinian	Roman and Soudet (1990), Néraudeau *et al*. (2001)
	P. vassalli (Wright, 1855)	Albacete (Spain)	Pliocene	Echinologia (2021)
Schizaster L**.** Agassiz, 1836	*S. eurynotus* (L. Agassiz in Agassiz and Desor, 1847b)	Seville (Spain)	Messinian	Bajo *et al*. (2008)
	S. lovisatoi Cotteau, 1895	Almeria (Spain)	Messinian	Roman and Soudet (1990)
	S. braidensis Botto Micca, 1896	Piedmont, Liguria (Italy)	Zanclean - Piacenzian	Airaghi (1901)
	" "	Emilia (Italy)	Zanclean - Piacenzian	Borghi (2021b)
	" "	Capo Milazzo, Salice (Sicily, Italy)	late Piacenzian to Calabrian	Borghi *et al*. (2014)
Schizobrissus Pomel, 1869	*Schizobrissus* sp.	Mediterranean area	Messinian-Pliocene	Néraudeau *et al*. (2001)
	S. cruciata (L. Agassiz in Agassiz and Desor, 1847b)	Melilla (North Africa)	Messinian	Lachkhem and Roman (1995)
Sardospatangus Stara, Cherbonnier and Borghi, 2018	*S. pustulosus* (Wright, 1864)	Malta	Messinian	Stefanini (1908)
	S. saheliensis (Pomel, 1887)	Almeria (Spain)	Messinian to Pliocene	Roman and Soudet (1990)
	" "	Melilla (North Africa)	Messinian	Lachkhem and Roman (1995)
	" "	North Africa	Messinian - Pliocene	Néraudeau *et al*. (2001)
	S. rovasendai (Airaghi, 1901)	Pecetto (Piedmont, Italy)	Pliocene	Airaghi (1901)
Spatangus Gray, 1825	*S. purpureus* (Muller, 1776)	Seville (Spain)	Messinian	Bajo *et al*. (2008)
		Almeria (Spain)	Zanclean - Piacenzian	Roman and Soudet (1990)
		Andalusia (Spain)	Piacenzian	Echinologia (2021)
		Pianosa Isle (Tuscany, Italy)	Piacenzian	Simonelli (1889)

		Emilia (Italy)	Calabrian	Nèraudeau *et al*. (1998)
		Anzio (Lazio, Italy)	Gelasian	Checchia Rispoli, 1923
		Favignana Isle (Sicily, Italy)	Calabrian	Borghi and Garilli (2017)
		Mediterranean Sea	Recent	Tortonese (1965)
	Spatangus sp.	Puglia, Tuscany (Italy) Ostia (Rome, Italy)	Pliocene Holocene	Stara *et al*. (2018)
Trachyaster Pomel, 1869	*T. globulus* Pomel, 1869	Mediterranean area	Messinian	Néraudeau et al. (2001)
		Algeria	Pliocene	Smith and Kroh (2011)
Trachypatagus Pomel, 1869	*T. oranesis* Pomel, 1869	Melilla (North Africa)	Messinian	Lachkhem and Roman (1995)
		North Africa	Messinian	Néraudeau *et al.* (2001)
		Almeria (Spain)	Zanclean - Piacenzian	Roman and Soudet (1990)
	T. gouini Pomel, 1887	Algeria	Pliocene	Pomel (1887)

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TABLE S2. Quantitative data on bathymetrical distribution of shelf-preferring/exclusive echinoid genera that still live or lived in Mediterranean during the late Caenozoic. Number of records and relative percentages are from the centennial data set collected by OBIS (2021) available at https://obis.org.

Echinoid genera/depth	0-50 m		50-100 m		100-200 m		200-4000 m		TOT records
	records	%	records	%	records	%	records	%	
Arbacia	358	89,5	42	10,5	-	-	-	-	400
Brissus	35	97,22	1	2,77	-	-	-	-	36
Centrostephanus	5125	99,67	17	0,33	-	-	-	-	5142
Clypeaster	1014	61,3	282	17,05	141	8,54	217	13,11	1654
Diadema	8931	99,23	69	0,77	-	-	-	-	9000
Echinocardium	783	93,77	23	2,75	2	0,24	27	3,23	835
Echinolampas	5	13,51	29	78,38	2	5,4	1	2,7	37
Echinoneus	17	85	3	15	-	-	-	-	20
Eucidaris	283	81,62	630	18,18	-	0,19	203	-	1116
Genocidaris	844	21,05	188	78,95	2	-	-	-	1034
Ova	8	33,33	30	66,66	-	-	-	-	38
Echinus	2	25,36	4	56,45	-	-	-	18,19	6
Paracentrotus	5	100	-	-	-	-	-	-	5
Plagiobrissus	18	94,74	1	5,26	-	-	-	-	19
Prionocidaris	16	17,58	53	58,24	22	24,17	-	-	91
Psammechinus	3771	89,13	445	10,52	15	-	-	0,35	4231
Schizaster	8	61,54	2	15,38	2	15,38	1	7,69	13
Sphaerechinus	114	42,54	152	56,72	2	0,74	-	-	268
Stylocidaris	21	7,39	188	66,2	38	13,38	37	13,03	284
Tripneustes	906	100	-	-	-	-	-	-	906

TABLE S3. Average annual sea surface temperatures (SSTs) reported for echinoid genera that still live or lived in Mediterranean during the late Caenozoic. Data are expressed in number of records and relative percentage as reconstructed by OBIS (2021, available at https://obis.org) and personal data of the first Author (see references and data in Table S4). SSTs are from various sources: NOAA (2002), OBIS (2021) and Pisano et al. (2020) for the Mediterranean localities. SSTs of taxa that inhabited Mediterranean deep environments are not indicative and were not considered for the reconstruction of the climatic requirements.

Temperatures/living genera	**below 0°C**		**0-5°C**		**5-10°C**		**10-15°C**		**15-20°C**		**20-25°C**		**25-30°C**		**TOT records**
	n. records	**%**	**n. records**	**%**	**n. records**	**%**	**n. records**	**%**	**n. records**	**%**	**n. records**	**%**	**n. records**	**%**	
REGULARS															
Arbacia		-	-	-	138	5.29	727	27.89	495	18.99	726	27.85	521	19.98	2607
Centrostephanus		-	-	-	-	-	1150	13.64	6600	78.31	389	4.61	289	3.43	8428
Cidaris (generally deep waters)		-	-	-	34	5.10	23	3.45	364	54.57	101	15.14	145	21.74	667
Diadema		-	-	-	-	-	-	-	24	0.63	499	13.08	3292	86.29	3815
Echinus		-	6	0.002	2566	0.94	24594	90.55	71	-	44	-	-	-	27281
Eucidaris		-	-	-	-	-	-	-	-	-	440	20.55	1701	79.50	2141
Genocidaris		-	-	-	-	-	-	-	87	17.43	89	17.83	323	64.73	499
Gracilechinus		-	418	8.86	143	0.30	3145	66.67	876	18.57	67	0.14	68	0.14	4717
Histocidaris (deep taxon in Mediterranean)	1	0.29	-	-	19	5.5	72	20.93	84	24.42	51	14.82	117	34.01	344
Paracentrotus		-	-	-	-	-	101	0.45	1841	82.74	283	12.72	-	-	2225
Prionocidaris		-	-	-	-	-	-	-	-	-	455	36.87	779	63.13	1234
Psammechinus		-	-	-	188	0.17	10563	95.11	343	0.31	12	0.01	-	-	11106
Sphaerechinus		-	-	-	16	0.42	242	64.36	106	28.19	12	0.32	-	-	376
Stylocidaris		-	-	-	-	-	-	-	100	0.87	270	23.62	773	67.63	1143
Tripneustes		-	-	-	-	-	-	-	31	0.13	515	20.98	1909	77.76	2455

IRREGULARS														
Brissopsis	-	-	-	45	0.10	3139	68.18	421	9.14	197	4.28	802	17.42	4604
Brissus	-	-	-	-	-	4	1.08	115	31.16	61	16.53	189	51.22	369
Clypeaster	-	-	-	-	-	-	-	106	4.75	589	26.38	1538	68.87	2233
Echinocardium	-	47	0.18	-	-	338	1.28	23921	90.99	1843	7.01	140	0.53	26289
Echinocyamus	-	-	-	401	2.05	17578	89.87	501	2.56	263	1.34	816	4.17	19559
Echinolampas	-	-	-	-	-	-	-	-	-	40	13.89	248	86.11	288
Echinoneus	-	-	-	-	-	-	-	-	-	86	28.20	219	71.80	305
Granopatagus	-	-	-	-	-	-	-	24	85.71	3	10.71	1	3.58	28
Holanthus (deep taxon in Mediterranean)	-	20	9.85	3	1.48	104	51.23	29	14.28	14	6.90	33	16.26	203
Hypsoclypus (as *Conolampas* in OBIS, 2021)	-	-	-	-	-	-	-	-	-	-	-	55	100	55
Neolampas	-	-	-	-	-	-	-	4	17.39	3	13.04	16	69.56	23
Ova	-	-	-	-	-	2	0.73	222	81.32	49	17.95	-	-	273
Plagiobrissus	-	-	-	-	-	-	-	36	31.86	76	67.26	1	0.88	113
Schizaster (deep taxon in Mediterranean)	-	-	-	8	2.08	42	10.94	95	24.74	91	23.70	148	38.54	384
Spatangus	-	16	0.58	94	3.42	1879	68.33	690	25.09	71	2.58	-	-	2750
TOT records	1	507		3655		63703		37186		7339		14123		126514

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Table S4. List of echinoid genera discussed in the main text and their respective extant species with localities and average annual sea surface temperatures (SSTs). Localities and number of specimens are from literature and personal observations of the first Author. SSTs are from Pisano et al. (2020) and NOAA (2002), respectively for Mediterranean and outside the Mediterranean.

REGULAR ECHINOIDS					
Genus	**Species**	**Localities**	**References**	**N. of specimens**	**SSTs (°C)**
Arbacia Gray, 1835	*A. lixula* (Linnaeus, 1758)	Aegean Sea (Greece)	Koukouras *et al*. (2007)	115	15-20
		Calafuria (Italy)	This study	20	15-20
		Elba Is.(Italy)	This study	23	15-20
		Capraia Is. (Italy)	This study	17	15-20
		S. Andrea, Otranto (Italy)	This study	7	15-20
		Favignana Is. (Italy)	This study	55	15-20
		Pantelleria Is. (Italy)	This study	14	15-20
		Capo Malfatano, Sardinia (Italy)	This study	23	15-20
		Su Pallosu, Sardinia (Italy)	This study	18	15-20
		Castelsardo, Sardinia (Italy)	This study	11	15-20
		Peljesac (Croatia)	This study	14	15-20
		Gozo Is. (Malta)	This study	15	15-20
		Monastir (Tunisia)	This study	15	15-20
		Boavista (Cape Verde)	Wangensteen *et al.* (2021)	27	20-25
		Los Gigantes (Macaronesia,	Wangensteen *et al*. (2021)	24	20-25
		Spain)	Wangensteen *et al*. (2021)	20	20-25
		Itapu (Brasil)	Wangensteen *et al*. (2021)	15	20-25
		Cabo Frio (Brasil)	Wangensteen *et al*. (2021)	24	20-25
		Tenerife, Canary Is. (Spain)	Wangensteen *et al*. (2021)	24	20-25
		Faial-Pico, Azores Is. (Portugal)	Wangensteen *et al*. (2021)	24	20-25
Centrostephanus Peters, 1855	*C. longispinus* (Philippi, 1845)	Aegean Sea (Greece)	Koukouras *et al*. (2007)	3	15-20
		Minorca Is. (Spain)	Templado and Moreno (1996)	19	15-20
		Majorca Is. (Spain)	Templado and Moreno (1996)	11	15-20
		Formentera Is. (Spain)	Templado and Moreno (1996)	2	15-20
		Alicante (Spain)	Templado and Moreno (1996)	1	15-20
		Cabo Cope (Spain)	Templado and Moreno (1996)	1	15-20

		Terreros Is., Almería (Spain)	Templado and Moreno (1996)	1	15-20
		Los Escullos, Almeria (Spain)	Templado and Moreno (1996)	2	15-20
		Bahía de Almería (Spain)	Templado and Moreno (1996)	3	15-20
		Balerma (Spain)	Templado and Moreno (1996)	1	15-20
		La Herradura, Granada (Spain)	Templado and Moreno (1996)	4	15-20
		Alborán Is. (Spain)	Templado and Moreno (1996)	1	15-20
		Calaburras, Málaga (Spain)	Templado and Moreno (1996)	10	15-20
		Chafarinas Is. (Spain)	Templado and Moreno (1996)	19	15-20
		Marmara Sea (Turkey)	Öztoprak *et al*. (2014)	7	15-20
		Aegean Sea (Turkey)	Öztoprak *et al*. (2014)	12	15-20
		Levant Sea (Turkey)	Öztoprak *et al*. (2014)	21	20-25
Cidaris Leske, 1778	*C. cidaris* (Linnaeus, 1758)	Aegean Sea (Greece)	Koukouras *et al*. (2007)	30	15-20
		Marmara Sea (Turkey)	Öztoprak *et al*. (2014)	5	15-20
		Aegean Sea (Turkey)	Öztoprak *et al*. (2014)	2	15-20
		Levant Sea (Turkey)	Öztoprak *et al*. (2014)	12	20-25
		Pantelleria Is. (Italy)	This study	4	15-20
		Circeo (Italy)	This study	1	15-20
Diadema Gray, 1825	*D. antillarum* Mortensen, 1909	Ascension Is.	Pawson (1978)	20	25-30
	D. mexicanum A. Agassiz, 1863	Panama (Atlantic coast)	Lessios (2005)	1	25-30
	D. savignyi (Audouin, 1809)	South Africa	Filander and Griffith (2017)	1	20-25
	D. setosum (Leske, 1778)	Levant Sea (Turkey)	Öztoprak *et al*. (2014)	26	20-25
		Aqaba (Jordan)	This study	34	20-25
		Giftun Is., Hurgada (Egypt)	This study	16	20-25
		Eriyadu Is. (Maldives)	This study	26	25-30
Echinus Linnaeus, 1758	*E. esculentus* Linnaeus, 1758	Greenland and Iceland	Mortensen (1903)	6	0-5
	E. gilchristi Bell, 1904	South Africa	Filander and Griffith (2017)	44	20-25
	E. melo Olivi, 1792	Aegean Sea (Greece)	Koukouras *et al*. (2007)	52	15-20
		Aegean Sea (Turkey)	Öztoprak *et al*. (2014)	7	15-20
		Capo Teulada, Sardinia (Italy)	This study	12	15-20
Eucidaris Pomel, 1883	*E. clavati* Mortensen, 1928	Ascension Is.	Pawson (1978)	4	25-30
	E. metularia (Lamarck, 1816)	Aqaba (Jordan)	This study	2	20-25
	E. thouarsii (L. Agassiz & Desor, 1846)	Panama (Atlantic coast)	Lessios (2005)	1	25-30
Genocidaris Agassiz, 1869	*G. maculata* Agassiz, 1869	Aegean Sea (Greece)	Koukouras *et al*. (2007)	1	15-20
		Aegean Sea (Turkey)	Öztoprak *et al*. (2014)	8	15-20

		Marmara Sea (Turkey)	Öztoprak *et al*. (2014)	2	15-20
		Capraia Is. (Italy)	This study	2	15-20
		Elba Is. (Italy)	This study	1	15-20
		Aci Castello, Sicily (Italy)	This study	6	15-20
		Favignana Is. (Italy)	This study	2	15-20
		Pantelleria Is. (Italy)	This study	2	15-20
Gracilechinus Fell & Pawson, 1965	*G. acutus* (Lamarck, 1816)	Aegean Sea (Greece)	Koukouras *et al*. (2007)	53	15-20
		Greenland and Iceland	Mortensen (1903)	32	0-5
		Aegean Sea (Turkey)	Öztoprak *et al*. (2014)	12	15-20
		Marmara Sea (Turkey)	Öztoprak *et al*. (2014)	7	15-20
		Elba Is. (Italy)	This study	1	15-20
		Capo Teulada, Sardinia (Italy)	This study	22	15-20
		Pantelleria Is. (Italy)	This study	1	15-20
		Savona (Italy)	This study	3	15-20
	G. affinis (Mortensen, 1903)	Greenland and Iceland	Mortensen (1903)	89	0-5
	G. alexandri (Danielssen & Koren, 1883)	Greenland and Iceland	Mortensen (1903)	285	0-5
	G. elegans Duben & Koren 1844	Greenland and Iceland	Mortensen (1903)	12	0-5
Paracentrotus Mortensen, 1903	*P. lividus* (Lamarck, 1816)	Aegean Sea (Greece)	Koukouras *et al*. (2007)	331	15-20
		Elba Is. (Italy)	This study	56	15-20
		Capraia Is. (Italy)	This study	22	15-20
		Santa Marinella (Italy)	This study	17	15-20
		Palmaria Is. (Italy)	This study	61	15-20
		S. Andrea, Otranto (Italy)	This study	17	15-20
		Favignana Is. (Italy)	This study	194	15-20
		Pantelleria Is. (Italy)	This study	21	15-20
		Capo Malfatano, Sardinia (Italy)	This study	78	15-20
		Su Pallosu, Sardinia (Italy)	This study	111	15-20
		Castelsardo, Sardinia (Italy)	This study	19	15-20
		Peljesac (Croatia)	This study	47	15-20
		Gozo Is. (Malta)	This study	35	15-20
		Monastir (Tunisia)	This study	75	15-20
		Milos Is. (Greece)	This study	7	15-20
		NE Creta Is. (Greece)	This study	46	15-20
Prionocidaris Agassiz, 1863	*P. australis* (Ramsay, 1855)	Nuova Caledonia	Guille *et al*. (1986)	1	25-30

	P. baculosa(Lamarck, 1816)	Suez Gulf (Egypt)	Dolfus and Roman (1981)	8	20-25
		Aqaba (Jordan)	This study	2	20-25
	P. pistillaris (Lamarck, 1816)	South Africa, Eastern coast	Filander and Griffith (2017)	23	20-25
Psammechinus Agassiz, 1846	*P. microtuberculatus* (Blainville, 1825)	Northern Tyrrhenian Sea (Italy)	Borri *et al*. (1990)	1	15-20
		SW Portugal	Cunha and Cancela (1999)	1	15-20
		Aegean Sea (Greece)	Koukouras *et al*. (2007)	131	15-20
		Marmara Sea (Turkey)	Öztoprak *et al*. (2014)	3	15-20
		Aegean Sea (Turkey)	Öztoprak *et al*. (2014)	17	15-20
		Levant Sea (Turkey)	Öztoprak *et al*. (2014)	12	20-25
		Orbetello (Italy)	This study	32	15-20
Sphaerechinus Desor, 1856	*S. granularis* (Lamarck, 1816)	Aegean Sea (Greece)	Koukouras *et al*. (2007)	47	15-20
		Marmara Sea (Turkey)	Öztoprak *et al*. (2014)	3	15-20
		Aegean Sea (Turkey)	Öztoprak *et al*. (2014)	12	15-20
		Levant Sea (Turkey)	Öztoprak *et al*. (2014)	12	20-25
		Peljesac (Croatia)	This study	4	15-20
		Palmaria and Tino Is. (Italy)	This study	3	15-20
		Calafuria (Italy)	This study	2	15-20
		Pantelleria Is. (Italy)	This study	3	15-20
Stylocidaris Mortensen, 1909	*S. affinis* (Philippi, 1845)	Aegean Sea (Greece)	Koukouras *et al*. (2007)	43	15-20
		Aegean Sea (Turkey)	Öztoprak *et al*. (2014)	12	15-20
		Marmara Sea (Turkey)	Öztoprak *et al*. (2014)	7	15-20
		Levant Sea (Turkey)	Öztoprak *et al*. (2014)	12	20-25
		Pantelleria Is. (Italy)	This study	3	15-20
	S. cingulata Mortensen, 1932	South Africa	Filander and Griffith (2017)	1	20-25
Tripneustes Agassiz, 1841	*T. depressus* A. Agassiz, 1863	Panama, Atlantic coast	Lessios (2005)	1	25-30
	T. gratilla (Linneus, 1758)	South Africa	Filander and Griffith (2017)	7	20-25
		Gulf of Mannar (India)	Venkatyraman *et al.* (2013)	2	25-30
		Praslin Is. (Seychelles)	This study	16	25-30
		Mahe Is., Anse Royal (Seychelles)	This study	3	25-30

IRREGULAR ECHINOIDS					
Genus	**Species**	**Localities**	**References**	**N. of specimens**	**SSTs (C°)**
Brissopsis L. Agassiz, 1840	*B. atlantica* Mortensen, 1913	SW Portugal	Cunha and Cancela (1999)	41	15-20
		Aegean Sea (Greece)	Koukouras *et al*. (2007)	1	15-20
		Aegean Sea (Turkey)	Öztoprak *et al*. (2014)	17	15-20
	B. lyrifera (Forbes, 1841)	Aegean Sea (Greece)	Koukouras *et al*. (2007)	4	15-20
		Northern Tyrrhenian Sea (Italy)	Borri et al. (1990)	6	15-20
	B. lyrifera capensis Mortensen, 1907	South Africa	Filander and Griffith (2017)	35	20-25
	B. pacifica A. Agassiz, 1898)	Gulf of California	Caso (1983)	24	20-25
Brissus Gray, 1825	*B. latecarinatus* (Leske, 1778)	Gulf of California	Caso (1983)	4	20-25
		Gulf of Mannar (India)	Venkatyraman *et al.* (2013)	9	25-30
		Aqaba (Jordan)	This study	2	20-25
	B. unicolor (Leske, 1778)	Aegean Sea (Greece)	Koukouras *et al*. (2007)	20	15-20

		Marmara Sea (Turkey)	Öztoprak *et al*. (2014)	19	15-20
		Aegean Sea (Turkey)	Öztoprak *et al*. (2014)	29	15-20
			This study	1	15-20
			This study	2	15-20
		Nora, Sardinia (Italy)	This study	2	15-20
		Su Pallosu, Sinis, Sardinia (Italy)			
		Correnti Is., Sicily (Italy)			
Clypeaster Lamarck, 1801	*C. eurychorius* Clark, 1925	South Africa	Filander and Griffith (2017)	7	20-25
	C. fervens Koehler, 1922	South Africa	Filander and Griffith (2017)	3	20-25
	C. humilis (Leske, 1778)	Suez Gulf (Egypt)	Dolfus and Roman (1981)	1	20-25
		Gulf of Mannar (India)	Venkatyraman *et al*. (2013)	68	25-30
		Isole Giftun, Hurgada (Egypt)	This study	2	20-25
		Praslin Is. (Seychelles)	This study	2	25-30
		Aqaba (Jordan)	This study	6	20-25
	C. rarispinus De Meijere, 1903	Suez Gulf (Egypt)	Dolfus and Roman (1981)	6	20-25
		South Africa	Filander and Griffith (2017)	8	20-25
		Gulf of Mannar (India)	Venkatyraman *et al.* (2013)	10	25-30
	C. reticulates (Linnaeus, 1758)	Suez Gulf (Egypt)	Dolfus and Roman (1981)	13	20-25
		Gulf of Mannar (India)	Venkatyraman *et al.* (2013)	19	25-30
		Aqaba (Jordan)	This study	6	20-25
		Giftun Is., Hurgada (Egypt)	This study	7	20-25
Echinocardium Gray, 1825	*E. cordatum* (Pennant, 1777)	Aegean Sea (Greece)	Koukouras *et al*. (2007)	59	15-20
		South Africa	Filander and Griffith (2017)	34	15-20
		Tyrrhenian coast, Tuscany (Italy)	This study	220	15-20
		Orbetello (Italy)	This study	89	15-20
		Porto Cesareo (Italy)	This study	2	15-20
	E. fenauxi Péquignat, 1963	SW Portugal	Cunha and Cancela (1999)	21	15-20
	E. flavescens (Müller, 1776)	Greenland and Iceland	Mortensen (1907)	47	0-5
		SW Portugal	Cunha and Cancela (1999)	3	15-20
	E. mediterraneum (Forbes, 1844)	Aegean Sea (Greece)	Koukouras *et al*. (2007)	24	15-20
		Marmara Sea (Turkey)	Öztoprak *et al*., 2014	9	15-20
		Aegean Sea (Turkey)	Öztoprak *et al*., 2014	17	15-20

		Tyrrhenian coast, Tuscany (Italy)	This study	15	15-20
		Grado (Italy)	This study	3	15-20
	E. mortenseni Thiéry, 1909	SW Portugal	Cunha and Cancela (1999)	5	15-20
		Pantelleria Is. (Italy)	This study	2	15-20
	E. pennatifidum Norman, 1892	SW Portugal	Cunha and Cancela (1999)	1	15-20
Echinocyamus Phelsum, 1774	*E. elegans* Mazzetti, 1893	South Africa	Filander and Griffith (2017)	11	20-25
	E. pusillus (Muller, 1776)	Aegean Sea (Greece)	Koukouras *et al*. (2007)	21	15-20
		Black Sea (Turkey)	Öztoprak *et al*. (2014)	29	15-20
		Marmara Sea (Turkey)	Öztoprak *et al*. (2014)	4	15-20
		Aegean Sea (Turkey)	Öztoprak *et al*. (2014)	12	15-20
		Levantine Sea (Turkey)	Öztoprak *et al*. (2014)	12	20-25
		Pantelleria Is. (Italy)	This study	117	15-20
		Favignana Is. (Italy)	This study	4	15-20
	E. scaber De Meijere, 1903	South Africa	Filander and Griffith (2017)	6	20-25
Echinolampas Gray, 1825	*E. alexandri* De Loriol, 1876	Suez Gulf (Egypt)	Dolfus and Roman (1981)	3	20-25
	E. crassa (Bell, 1880)	South Africa	Filander and Griffith (2017)	13	20-25
	E. ovata (Leske, 1778)	Gulf of Mannar (India)	Venkatyraman *et al.* (2013)	1	25-30
Echinoneus Leske, 1778	*E. cyclostomus* Leske, 1778	South Africa	Filander and Griffith (2017)	4	20-25
		Ascension Is.	Pawson (1978)	3	25-30
		Aqaba (Jordan)	This study	3	20-25
		Giftun Is., Hurgada (Egypt)	This study	1	20-25
		Mahe Is. (Seychelles)	This study	7	25-30
Granopatagus Lambert, 1915	*G. paucituberculatus*	Philippines Is.	Noordenburg (2008)	1	25-30
	(Agassiz & Clark, 1907)	Hawaiian Is.	Noordenburg (2008)	1	20-25
		Hawaiian Is.	Baker and Rowe (1990)	2	20-25
		Juan Fernandez Is. (Chile)	Baker and Rowe (1990)	1	15-20
		Victoria (Australia)	Baker and Rowe (1990)	3	15-20
	G. subinermis (Mortensen, 1913)	Napoli (Italy)	Tortonese (1965)	1	15-20
		Genova (Italy)	Tortonese (1965)	1	15-20
		Northern Tyrrhenian Sea (Italy)	Borri *et al*. (1990)	1	15-20
		Aegean Sea (Turkey)	Öztoprak *et al*. (2014)	17	15-20
Holanthus Lambert & Thiéry, 1924	*H. expergitus* (Lovén, 1871)	Greenland and Iceland	Mortensen (1907)	19	0-5
		Aegean Sea (Greece)	Koukouras *et al*. (2007)	3	15-20
Neolampas A. Agassiz, 1869	*Neolampas costellata* A. Agassiz, 1869	Northern Tyrrhenian Sea (Italy)	Borri et al. (1990)	2	15-20

Ova Gray, 1825	*O. canalifera* (Lamarck, 1816)	Aegean Sea (Greece)	Koukouras *et al*. (2007)	10	15-20
		Marmara Sea (Turkey)	Öztoprak *et al*. (2014)	5	15-20
		Aegean Sea (Turkey)	Öztoprak *et al*. (2014)	17	15-20
		Orbetello (Italy)	This study	16	15-20
		Porto Garibaldi (Italy)	This study	9	15-20
		Chioggia (Italy)	This study	4	15-20
Plagiobrissus Pomel, 1883	*P. costae* (Gasco, 1876)	Napoli (Italy)	Tortonese (1965)	2	15-20
		Taranto (Italy)	Tortonese (1965)	1	15-20
		Haifa (Israel)	Tortonese (1965)	1	15-20
		Aegean Sea (Greece)	Koukouras *et al*. (2007)	1	15-20
		Pantelleria Is. (Italy)	This study	1	15-20
	P. pacificus Clark, 1940	Gulf of California	Caso, 1983	18	20-25
		Panama, Atlantic coast	Lessios, 2005	1	25-30
Schizaster L. Agassiz, 1835	*Schizaster lacunosus* (Linnaeus, 1758)	Nuova Caledonia	Guille *et al*. (1986)	1	25-30
		South Africa	Filander and Griffith (2017)	11	20-25
Spatangus Gray, 1825	*S. californicus* Clark, 1917	Gulf of California (Mexico)	Caso (1983)	9	20-25
	S. capensis Doderlein, 1905	South Africa, south-western coast	Filander and Griffith (2017)	24	20-25
	S. purpureus (Muller, 1778)	Greenland and Iceland	Mortensen (1907)	16	0-5
		Northern Tyrrhenian Sea (Italy)	Borri *et al*. (1990)	11	15-20
		SW Portugal	Cunha and Cancela (1999)	2	15-20
		Aegean Sea (Greece)	Koukouras *et al*. (2007)	2	15-20
		Marmara Sea (Turkey)	Öztoprak *et al*. (2014)	5	15-20
		Aegean Sea (Turkey)	Öztoprak *et al*. (2014)	12	15-20
		Levant Sea (Turkey)	Öztoprak *et al*. (2014)	12	20-25
		Capo Teulada, Sardinia (Italy)	This study	72	15-20

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TABLE S5. Classes of sea surface temperature (SST) requirements showed by still living echinoid genera accross the Mediterranean late Caenozoic and related plot. The SST classes as from OBIS (2021) more or less correspond to the following climatic marine zones: subpolar (5-10°C), subtropical-temperate (10-20°C) and tropical-equatorial(20-30°C). The Late Pleistocene interval has not been considered because of the scarcity of the palaeontological record. Note the remarkable drop of the 20-30°C class (well represented within the warmer taxa) corresponding to the Piacenzian climatic crisis at about 3.0 Ma. Also note that single eurithermic taxa normally fall within more than one class and therefore each climatic class is not necessarely linked to a single taxon. Consequently a single taxon may count more than one class.

Stratigraphy	5-10°C	10-20°C	20-30°C
Messinian	5	15	18
Zanclean (preNHG)	5	15	18
Piacenzian (pre 3.0 Ma)	6	15	17
Piacenzian (post 3.0 Ma)	5	13	12
Gelasian	5	13	12
Calabrian	6	14	12
Holocene	6	15	12